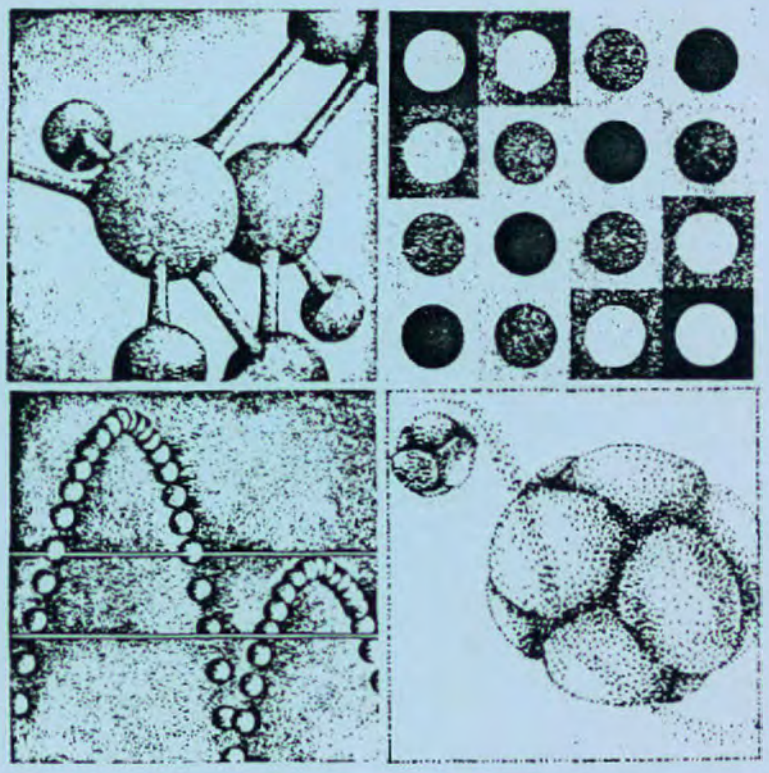
Grade 12 Diploma Examinations Program

Mathematics & Sciences



1988-89 School Year

Alberta
EDUCATION
Student Evaluation and Records Branch
August 1988

NOTE

Changes to this year's examinations appear on the following pages:

Page 4	Biology 30
Page 7	Chemistry 30
Page 9	Physics 30
Page 11	Mathematics 30
Page 21	Use of Calculators

TABLE OF CONTENTS

	Page
INTRODUCTION	
Purpose of the Bulletin	1
GENERAL INFORMATION	2
General Format of Examinations	2
Examinations Schedule	2
Preparation of the Examinations	3
Scoring of the Examinations	3
DESCRIPTION OF THE DIPLOMA EXAMINATIONS	4
BIOLOGY 30	4
CHEMISTRY 30	7
PHYSICS 30	9
MATHEMATICS 30	11
APPENDIX A: GUIDELINES FOR SIGNIFICANT DIGITS, MANIPULATION OF DATA, AND ROUNDING	18
APPENDIX B: EXPLANATION OF COGNITIVE LEVELS	20
APPENDIX C: USE OF CALCULATORS	21

INTRODUCTION

Purpose of the Bulletin

The purpose of this bulletin is to provide information to teachers and students about the diploma examinations in Mathematics 30, Biology 30, Chemistry 30, and Physics 30 that will be administered during January, June, and August 1989. The bulletin explains the design of the examinations and how they will be marked.

Teachers are encouraged to inform their students of the content of the bulletin. In addition, students should have the opportunity to acquaint themselves with the nature and complexity of questions that appeared on previously administered Mathematics, Biology, Chemistry, and Physics diploma examinations.

Teachers and students should also refer to the curriculum specifications for each subject. These publications describe the specific content and objectives from which the test questions for the diploma examinations are developed. Teachers may also wish to refer to the Alberta Education publication entitled *General Information Bulletin* which is distributed to all senior high school administrators.

If you have questions or comments regarding this bulletin, please contact:

Associate Director, Mathematics and Sciences
Student Evaluation and Records Branch
Alberta Education
Devonian Building, West Tower
11160 Jasper Avenue
EDMONTON, Alberta T5K 0L2
Phone: 427-2948

or the nearest Alberta Education Regional Office:

Grande Prairie Regional Office
5th Floor, Nordic Court
10014 - 99 Street,
Grande Prairie, Alberta T8V 3N4
Phone: 538-5130

Edmonton Regional Office
8th Floor, Harley Court Building
10045 - 111 Street,
Edmonton, Alberta T5K 1K4
Phone: 427-2952

Calgary Regional Office
12th Floor, Rocky Mountain Plaza
615 Macleod Trail S.E.,
Calgary, Alberta T2G 4T8
Phone: 297-6353

Red Deer Regional Office
3rd Floor West, Provincial Building
4920 - 51 Street,
Red Deer, Alberta T4N 6K8
Phone: 340-5262

Lethbridge Regional Office
Provincial Building
200 - 5 Avenue South,
Lethbridge, Alberta T1J 4C7
Phone: 381-5243

GENERAL INFORMATION

General Format of Examinations

The time allotted for the diploma examinations in the mathematics and science subjects is two and one-half hours. The examinations consist of both machine - scorable questions (worth 70% to 80% of the total examination mark) and written-response questions (worth 20% to 30% of the total examination mark).

In the written-response portion of each examination, the marks assigned to each question are shown in the margin beside the question. Students are expected to communicate their answers clearly and completely, to identify the steps in a solution, and to use annotated sketches or diagrams where appropriate. Guidelines for the use of significant digits required in the Chemistry 30 and Physics 30 examinations are listed in Appendix A. These guidelines are based on those prepared by the Canadian Standards Association.

Each examination is designed to reflect that subject's core concepts as outlined in the *Program of Studies for Senior High Schools*.

To the extent that pencil-and-paper testing permits, the Biology 30, Chemistry 30, and Physics 30 diploma examinations assess the student's ability to apply the scientific process skills of predicting, hypothesizing, controlling variables, classifying, interpreting data, observing, inferring, designing experiments, and defining in operational terms.

Understandably, the experience gained by hands-on activity is difficult to measure outside a laboratory situation and, therefore, should be included in the teacher's evaluation of student performance.

The attitudinal and psychomotor components of the programs are not evaluated by the diploma examinations.

Examinations Schedule

Dates for the administration of the 1989 Mathematics and Sciences diploma examinations are as follows:

January 26, 1989:	Chemistry 30	1:00 - 3:30 p.m.
January 27, 1989:	Physics 30	1:00 - 3:30 p.m.
January 30, 1989:	Mathematics 30	9:00 - 11:30 a.m.
	Biology 30	1:00 - 3:30 p.m.
June 23, 1989:	Chemistry 30	1:00 - 3:30 p.m.
June 26, 1989:	Physics 30	1:00 - 3:30 p.m.
June 27, 1989:	Mathematics 30	9:00 - 11:30 a.m.
June 28, 1989:	Biology 30	9:00 - 11:30 a.m.
August 15, 1989:	Chemistry 30	1:00 - 3:30 p.m.
August 16, 1989:	Biology 30	9:00 - 11:30 a.m.
	Mathematics 30	1:00 - 3:30 p.m.
August 17, 1989:	Physics 30	9:00 - 11:30 a.m.

Students must provide their own HB pencils, erasers, blue, black, or blue-black pens, and an approved scientific calculator for the math-science diploma examinations. Students should also bring rulers and protractors. No other aids will be permitted in the examination room without the permission of the Director of the Student Evaluation and Records Branch.

Preparation of the Examinations

Teacher-written questions of the type that will appear on the diploma examinations are field-tested in high schools across the province. Test development specialists, in conjunction with teachers, build the examinations from suitable questions. Before the examinations are administered, they are reviewed by Diploma Examination Review Committees, which consist of representatives from the Conference of Alberta School Superintendents, the Alberta Teachers' Association, the Public Colleges of Alberta, the Universities Co-ordinating Council, and Alberta Education.

Scoring of the Examinations

The multiple-choice and short answer, scannable questions portion of each examination will be machine scored.

The written-response questions will be marked by teachers who have been recommended by their superintendents and appointed by the Student Evaluation and Records Branch.

To be eligible to mark, a teacher must have taught the course for two or more years, be currently teaching the course, and have a valid Alberta Permanent Professional Teaching Certificate. Teachers who wish to be recommended as markers should contact their superintendents as soon as possible.

Following each administration of the 1989 diploma examinations, the written-response sections will be marked in Edmonton during February, July, and August.

Markers will review a suggested marking key, discuss allowable variations, and make necessary changes to the key. While consistency in marking will be closely monitored, allowances will be made for unique and creative solutions.

Content

Each Biology 30 diploma examination is designed to reflect the Biology 30 core concepts that are outlined in the *Program of Studies for Senior High Schools.*

The concepts on the Biology 30 diploma examination are emphasized as follows:

Concept	Emphasis in Per Cent of the Total Examination Mark
Cellular processes are fundamental to life	9
Homeostatic mechanisms regulate the body and its systems	4
Humans must take in and process the required nutrients for absorption	16
Body fluids distribute essential nutrients to, and carry wastes away from, tissues	15
Breathing precedes gas exchange and transport	7
Energy is released by the oxidation of organic compounds	5
The kidney provides homeostatic control over body fluids	10
Regulation of the internal environment requires co-ordination between the nervous and hormonal systems	20
Voluntary movement and body support are the result of skeletal muscles and the skeletons to which they are attached	4
Humans are capable of reproducing	10
	100%

Blueprint for the Examination

Seventy marks are allotted to the multiple-choice questions and 30 marks are allotted to the written-response questions on the Biology 30 diploma examination.

Emphases for the 1989 Diploma Examinations in Biology

1. The 30 marks allotted to the written-response section of the 1989 Biology 30 examinations will be divided among five to eight questions. For each question, an in-depth answer will be required.

2. Only the total value of each written-response question will be printed in the margin. If a question has subparts, the value of each will NOT be presented. The intention of this format is to encourage the student to consider the question as a whole. The answers should be expressed in a comprehensive manner rather than in a disjointed form.

Prohibition of Laboratory Use of Human Fluids and Tissues - Implications for Biology 30 Diploma Examinations

Context-dependent questions relating to human fluids and tissues will continue to be presented, but the scientific procedures inferred will reflect a setting other than that of a high school laboratory. Questions which are based

directly on high school biology laboratory activities will be in keeping with policies and procedures described in the Alberta Education Curriculum Support Branch document entitled "Clarification of Statements Prohibiting the Use of Human Body Substances in the Alberta Science Curriculum."

BIOLOGY 30
Distribution of Questions by Percentage of Total Mark

CONCEPT[1] / COGNITIVE LEVEL[2]	KNOWLEDGE	COMPREHENSION AND APPLICATION	HIGHER MENTAL ACTIVITIES	TOTAL
Cellular Processes	2	5	2	9
Homeostatic Mechanisms	1	2	1	4
Nutrition and Digestion	4	9	3	16
Body Fluids	4	9	2	15
Breathing, Gas Exchange, and Transport	2	3	2	7
Energy Release	1	2	2	5
The Kidney	3	6	1	10
Regulation of the Internal Environment	5	11	4	20
Voluntary Movement and Body Support	1	2	1	4
Human Reproduction	2	6	2	10
TOTAL	25	55	20	100

[1]Concept descriptions have been shortened in this table.

[2]Questions that require knowledge and skill in the application of scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels. An explanation of each cognitive level is given in Appendix B.

Biology 30 Terminology

Terms from the following list may appear written in full or in abbreviated or symbolic form on the Biology 30 diploma examinations.

ADH	antidiuretic hormone
ADP	adenosine diphosphate
AMP	adenosine monophosphate
ATP	adenosine triphosphate
AV	atrioventricular
Ca^{2+}	calcium ion
Cl^-	chloride ion
CO_2	carbon dioxide
DNA	deoxyribonucleic acid
ECF	extracellular fluid
ER	endoplasmic reticulum
FSH	follicle stimulating hormone
GH	growth hormone
H^+	hydrogen ion
Hb	hemoglobin
HCl	hydrochloric acid
HCO_3^-	bicarbonate ion
H_2O	water
ICSH	interstitial cell stimulating hormone
LH	luteinizing hormone
NaCl	sodium chloride
Na^+	sodium ion
N_2	nitrogen gas
O_2	oxygen gas
pH	acidity of a solution
RNA	ribonucleic acid
SA	sinoatrial
TSH	thyroid stimulating hormone

Students are expected to know the symbolic form of any of the elements commonly used in the study of Biology 30.

CHEMISTRY 30

Content

Each Chemistry 30 diploma examination is designed to reflect the Chemistry 30 core concepts that are outlined in the *Program of Studies for Senior High Schools*.

The concepts on the Chemistry 30 diploma examination are emphasized as follows:

Concept	Emphasis in Per Cent of the Total Examination Mark
Chemical Energetics	32
Acids and Bases	34
Oxidation-Reduction	34
	100%

The prescribed course references present varying approaches to certain concepts in chemistry. Because of these discrepancies, the Student Evaluation and Records Branch uses the following guidelines.

a. Chemical Energetics

Heat of reaction (ΔH) can be calculated from heats of formation or by the addition of equations that include heat terms. Both methods of calculating ΔH will be tested.

The Student Evaluation Branch uses the symbols E_k and E_p for kinetic and potential energy respectively.[1]

b. Acids and Bases

This concept includes polyprotic species.

The concepts of K_a and % reaction can serve the same function in many acid-base calculations. Even though both values are given for the acids in the *Chemistry Data Booklet*, the student will not be required to use the K_a method of calculation to answer acid-base questions.

c. Oxidation-Reduction

Oxidation numbers and half-reactions can serve to balance redox equations. Both methods will be tested.

---

[1]These symbols are recommended by the Canadian Standards Association.

Blueprint for the Examination

Fifty-six marks are allotted to the multiple-choice questions and 14 marks are allotted to the written-response questions on each Chemistry 30 diploma examination.

CHEMISTRY 30
Distribution of Questions by Percentage of Total Mark

CONCEPT[1] / COGNITIVE LEVEL[2]	KNOWLEDGE	COMPREHENSION AND APPLICATION	HIGHER MENTAL ACTIVITIES	TOTAL
Chemical Energetics	11	16	5	32
Acids and Bases	12	17	5	34
Oxidation-Reduction	12	17	5	34
TOTAL	35	50	15	100

[1] Concept descriptions have been shortened on this table.

[2]Questions that require knowledge and skill in the application of scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels. An explanation of each cognitive level is given in Appendix B.

Emphasis for the 1989 Diploma Examinations in Chemistry

1. In the multiple-choice and the written-response sections of the 1989 Chemistry 30 examinations, individual questions may include concepts from more than one unit.

2. The written-response questions on the 1989 Chemistry 30 examinations will continue to include a written component that requires students to draw relationships among concepts learned.

Content

Each Physics 30 diploma examination is designed to reflect the Physics 30 core concepts that are outlined in the *Program of Studies for Senior High Schools*.

The concepts on the Physics 30 diploma examination are emphasized as follows:

Concept	Emphasis in Per Cent of the Total Examination Mark
Nature and Behavior of Light	23
Electric and Magnetic Fields	27
Electromagnetic Radiation	15
Structure of Matter	20
Modern Physical Theories	15
	100%

The 1987 revision of the data sheet has the following changes.

a. Mass and radius of Earth are included in the table of constants.

b. The symbol E is reserved for energy, while the symbol $|\vec{E}|$ is used for the magnitude of the electric field vector.

The prescribed course references present different approaches to the measurement of wavelengths in the visible region of the electromagnetic spectrum. Because of these discrepancies, the Student Evaluation and Records Branch uses the following guidelines.

a. Double-Slit Method

The formula $\lambda = dx/nl$ can be used for calculations of wavelengths, and students may be tested on this.

b. Diffraction Grating Method

The formula $\lambda = (d \sin \theta)/n$ can be used to calculate angles directly. The formula $\lambda = dx/nl$, together with appropriate use of trigonometry, can provide an answer that is a good approximation for small angles of diffraction. Multiple-choice examination questions are keyed to $\lambda = (d \sin \theta)/n$, but students who use $\lambda = dx/nl$ will not be penalized. Written-response questions will have scoring guides that allow for the use of either formula.

Blueprint for the Examination

Forty-nine marks are allotted to the multiple-choice questions and 21 marks are allotted to the written-response questions on the Physics 30 diploma examination.

PHYSICS 30
Distribution of Questions by Percentage of Total Mark

CONCEPT[1] / COGNITIVE LEVEL[2]	KNOWLEDGE	COMPREHENSION AND APPLICATION	HIGHER MENTAL ACTIVITIES	TOTAL
Nature and Behavior of Light	6	12	5	23
Electric and Magnetic Fields	6	16	5	27
Electromagnetic Radiation	4	8	3	15
Structure of Matter	5	11	4	20
Modern Physical Theories	4	8	3	15
TOTAL	25	55	20	100

[1]Concept descriptions have been shortened in this table.

[2]Questions that require knowledge and skill in the application of scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels. An explanation of each cognitive level is given in Appendix B.

Emphasis for the 1989 Diploma Examinations in Physics

1. Some questions will require the synthesis of concepts from more than one unit.

2. Some written-response questions will call for written explanation of experimental results or of calculation algorithms. A sample question was given in the 1987-88 edition of this bulletin.

3. In all written-response questions involving calculations, an explicit formula statement is required as a first step, with the substituted values explicitly written down in a subsequent step.

There will be three changes implemented on the 1989 Mathematics 30 diploma examinations. In addition, there will be one change in the manner of scoring the written-response questions. These changes are outlined below.

1. Calculators

All students will be expected to provide their own scientific calculator. The calculator must not have a graphing capability or be able to accept or display alphabetical information. Please refer to the calculator policy in Appendix C on pages 21 and 22.

2. Data Booklet

The data booklet as used in the past will no longer be supplied for use during the examination. In its place, each examination booklet will include an additional tear-out sheet that gives the z-score table on one side and the formulas on the reverse. Refer to pages 12 and 13 for samples of the tear-out sheet.

Note that the value of π is now given for those students who do not have this constant on their calculators.

3. Open-Ended Scannable Questions

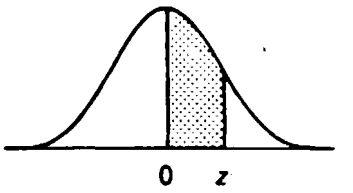
Instead of the customary 52 multiple-choice questions, the 1989 diploma examinations in Mathematics 30 will include 45 multiple-choice questions and 7 open-ended scannable questions worth one mark each. There will continue to be 3 written-response questions worth a total of 13 marks.

Students will be instructed to record all answers to scannable questions correct to the nearest tenth, and to code in any initial or final zeros. However, if these zeros are not coded in, the answers will still be marked correct. Refer to sample instructions and questions on page 14. A model of the answer sheet to be used is shown on page 15.

4. Rounding Answers

The instructions to the examination will state clearly that all numbers used in the examination are to be considered as exact numbers (did not arise from a measurement). In working solutions involving two or more steps, students are not to do any rounding off until the final step in the solution. Each written-response question will clearly state the number of decimal places to be shown in the answer. Students who round off improperly will have one mark deducted from their score. See page 16 for a sample marking key.

AREAS UNDER THE STANDARD NORMAL CURVE



z	0	1	2	3	4	5	6	7	8	9
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0754
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2258	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2518	0.2549
0.7	0.2580	0.2612	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2996	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998
3.6	0.4998	0.4998	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.7	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.8	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999	0.4999
3.9	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000

Formula Sheet

I. Trigonometry

1. $\pi = 3.14159$
2. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
3. $a^2 = b^2 + c^2 - 2bc \cos A$
4. $\sin^2 A + \cos^2 A = 1$
5. $1 + \tan^2 A = \sec^2 A$
6. $1 + \cot^2 A = \csc^2 A$
7. $\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$
8. $\cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta$
9. $\sin(A + B) = \sin A \cos B + \cos A \sin B$
10. $\sin(A - B) = \sin A \cos B - \cos A \sin B$
11. $\cos(A + B) = \cos A \cos B - \sin A \sin B$
12. $\cos(A - B) = \cos A \cos B + \sin A \sin B$
13. $\sin(-\theta) = -\sin \theta$
14. $\cos(-\theta) = \cos \theta$
15. $\tan(-\theta) = -\tan \theta$

II. Quadratic Relations

1. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
2. $d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$
3. $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
4. $(x - h)^2 + (y - k)^2 = r^2$
5. $x^2 + y^2 + Dx + Ey + F = 0$
6. $(y - k)^2 = 4p(x - h)$
7. $(x - h)^2 = 4p(y - k)$
8. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1,\ a^2 = b^2 + c^2$
9. $\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1,\ a^2 = b^2 + c^2$
10. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1,\ c^2 = a^2 + b^2$
11. $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1,\ c^2 = a^2 + b^2$

III. Sequences, Series, and Limits

1. $t_n = a + (n - 1)d$
2. $S_n = \frac{n(a + t_n)}{2}$
3. $S_n = \frac{n[2a + (n - 1)d]}{2}$
4. $A = P(1 + i)^n$
5. $t_n = ar^{n-1}$
6. $S_n = \frac{a(r^n - 1)}{r - 1}$
7. $S_n = \frac{rt_n - a}{r - 1}$
8. $S = \frac{a}{1 - r},\ -1 < r < 1$

IV. Statistics

1. $\mu = \frac{x_1 + x_2 + \ldots + x_n}{n}$
2. $\sigma = \sqrt{\frac{(x_1 - \mu)^2 + \ldots + (x_n - \mu)^2}{n}}$
3. $z = \frac{x - \mu}{\sigma}$

INSTRUCTIONS FOR PART B: OPEN-ENDED SCANNABLE QUESTIONS

Read each question carefully.

Solve each question and write your answer correct to the nearest tenth.

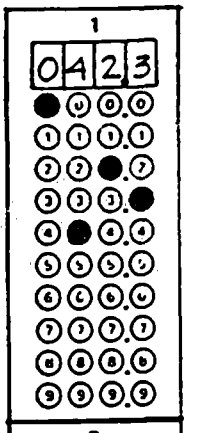
Record your answer on the answer sheet by writing it in the boxes of the corresponding answer field and by filling in one circle in EVERY column.

Sample Questions and Solutions

1) If θ is acute and $\sin\theta = 0.6735$, then the measure of θ correct to the nearest tenth of a degree is _____.

$\theta = 42.33777464...$

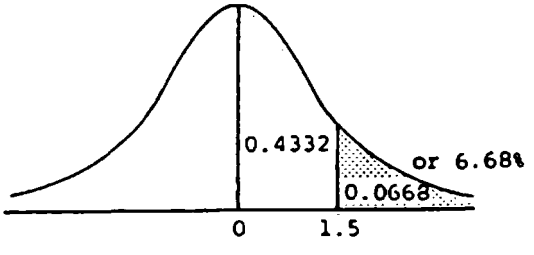
RECORD 042.3

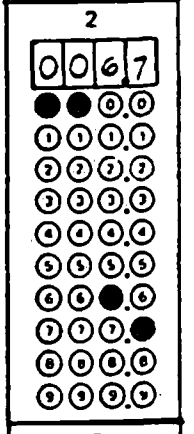


2) On a test with a mean of 57 and a standard deviation of 4, Bill received a mark of 63. Assuming a normal distribution, the percentage of his classmates with marks better than 63 correct to the nearest tenth is _____.

$z = \frac{63 - 57}{4} = 1.5$

RECORD 006.7





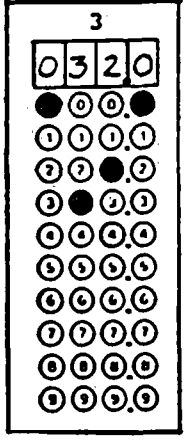
3) For the arithmetic series $-8 + (-5) + (-2) + \ldots + (85)$, the number of terms correct to the nearest tenth is _____.

$85 = -8 + (n - 1)(3)$

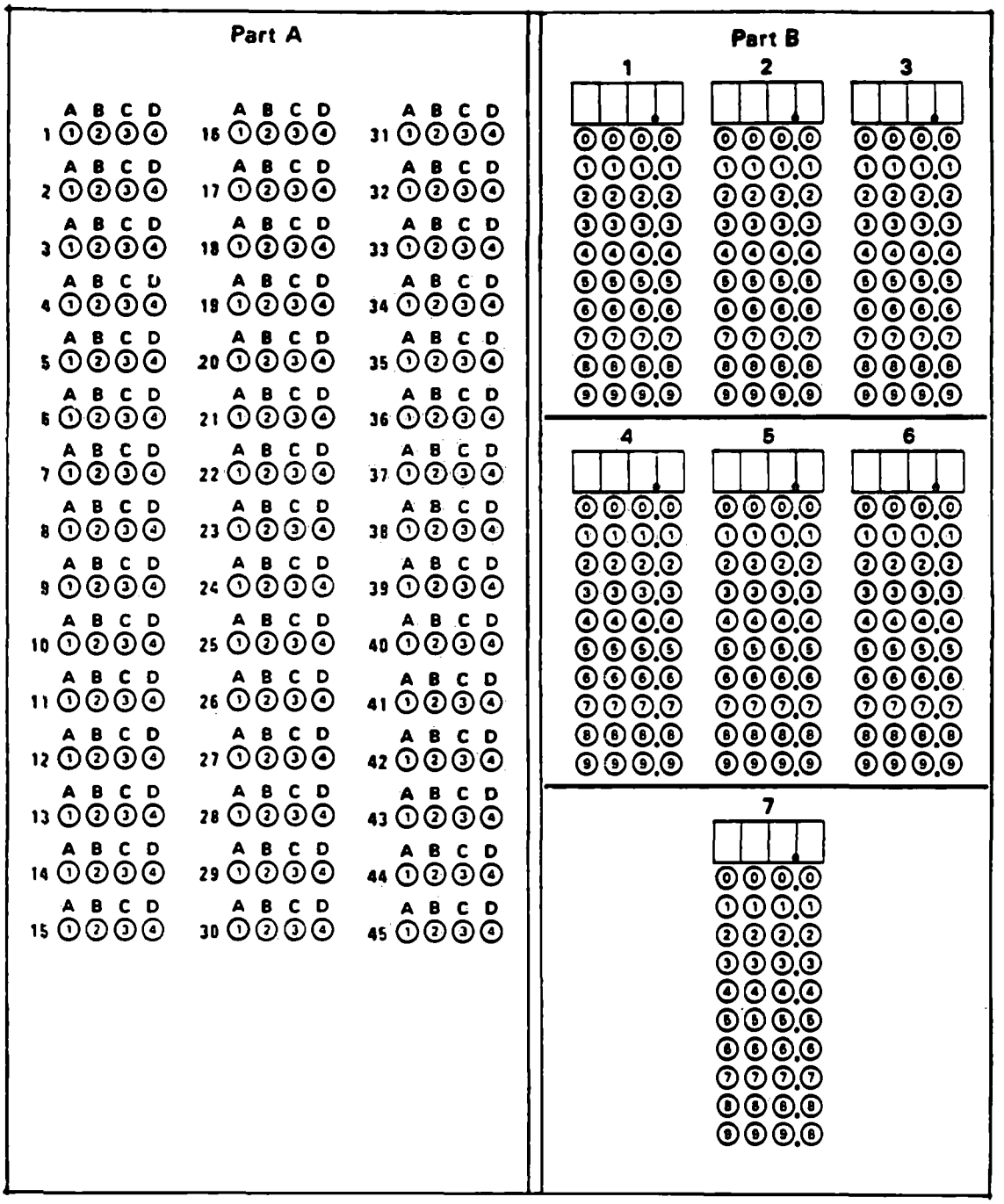
$93 = 3n - 3$

$n = 32$

RECORD 032.0

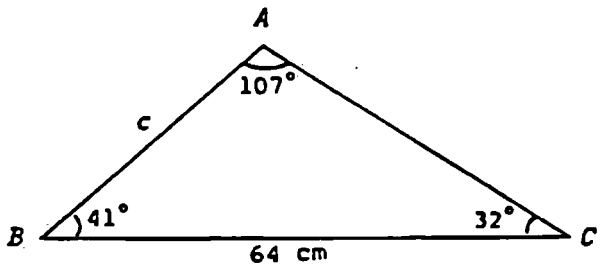
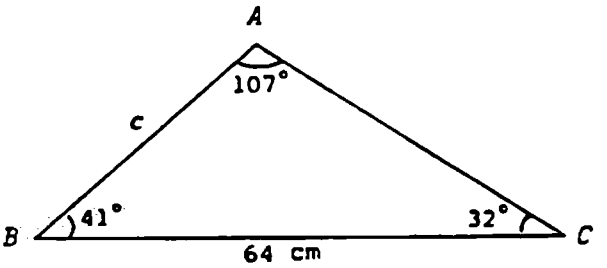


MODEL OF THE ANSWER SHEET



SAMPLE QUESTION AND MARKING KEY

In ΔABC, $\angle B = 41°$, $\angle C = 32°$, and $BC = 64$ cm. Find the area of ΔABC correct to two decimal places.

CORRECT SOLUTION	INCORRECT SOLUTION
	
$\frac{c}{\sin 32°} = \frac{64}{\sin 107°}$	$\frac{c}{\sin 32°} = \frac{64}{\sin 107°}$
* $c = 35.4644612...$	$c = 35.46$
* $A = \frac{1}{2}(63)(35.4644612...) \sin 41°$	$A = \frac{1}{2}(63)(35.46) \sin 41°$
$= 732.9035692$	$= 732.8113748$
The area is 732.90 cm^2	The area is 732.81 cm^2

If this were a 4 mark written-response question, then the incorrect solution shown above would receive 3 of the 4 possible marks (i.e. deduct one mark for improper rounding).

Students should become familiar with using the memories on their calculators so that eight or ten digit numbers do not have to be re-entered.

Students may wish to write the lines marked * as follows provided all the digits are used in the calculation.

$$c = 35.46...$$

$$A = \frac{1}{2}(63)(35.46...) \sin 41°$$

Content

Each Mathematics 30 diploma examination is designed to reflect the common-core and independent-core concepts that are outlined in the *Program of Studies for Senior High Schools*.

The concepts on the Mathematics 30 diploma examination are emphasized as follows:

Concept	Emphasis in Per Cent of the Total Examination Mark
Trigonometry	25
Quadratic Relations	22
Sequences, Series, and Limits	19
Statistics	15
Logarithms	9
Polynomial Functions	10
	100%

Blueprint for the Examinations

Question Format	# Items	# Marks	Percentage of Total Marks
Multiple-Choice	45	45	69.2
Open-Ended Scannable	7	7	10.8
Written-Response	3	13	20.0

Distribution of Questions by Percentage of Total Mark

CONCEPT / COGNITIVE[1] LEVEL	KNOWLEDGE COMPUTATION	COMPREHENSION	APPLICATION	HIGHER MENTAL ACTIVITIES	TOTAL
Trigonometry	2	10	10	3	25
Quadratic Relations	2	8	10	2	22
Sequences, Series, and Limits	2	6	9	2	19
Statistics	2	5	7	1	15
Logarithms	1	3	4	1	9
Polynomial Functions	1	3	5	1	10
Total	10	35	45	10	100

[1]An explanation of each cognitive level is given in Appendix B.

APPENDIX A: GUIDELINES FOR SIGNIFICANT DIGITS, MANIPULATION OF DATA, AND ROUNDING

The guidelines are based on those recommended by the Canadian Standards Association.

Significant Digits

1. Regardless of decimal position, any of the digits 1-9 is a significant digit, and 0 may be significant.

   e.g., 147 0.147 0.001 47 1.47×10^3 all have 3 significant digits

2. Leading zeros are not significant.

   e.g., 027 and 0.035 have 2 significant digits

3. Trailing zeros to the right of the decimal are significant.

   e.g., 0.127 00 and 20.000 have 5 significant digits

4. Zeros to the right of a whole number are ambiguous.

   e.g., 200

   If the number is an exact count, it is considered to be perfectly precise. Otherwise, it should be put into scientific notation.

   e.g., 2×10^2 has 1 significant digit
   2.0×10^2 has 2 significant digits
   2.00×10^2 has 3 significant digits

Manipulation of Data

1. When adding or subtracting measured quantities, the calculated answer should be rounded to the same degree of precision as that of the least precise of the numbers used in the computation.

   e.g., 38.5 (least precise)
   0.123
   19.54
   58.163

   The answer should be rounded to 58.2.

2. When multiplying or dividing measured quantities, the calculated answer should be rounded to the same number of significant digits as are contained in the quantity that has the fewest significant digits.

   e.g., 36.3 cm x 451.91 cm = 16 404.333 cm^2

   The answer should be rounded to 1.64×10^4 cm^2.

Rounding

1. When the first digit to be dropped is less than or equal to 4, the last digit retained should not be changed.

   e.g., 7.849 rounded to 2 digits is 7.8

2. When the first digit to be dropped is greater than or equal to 6, the last digit retained should be increased by one.

   e.g., 5.262 rounded to 2 digits is 5.3

3. When the first digit to be dropped is 5 followed by digits other than zeros, the last digit retained should be increased by one.

   e.g., 2.148 501 rounded to 4 digits is 2.149
   2.135 22 rounded to 3 digits is 2.14

4. When the first digit to be discarded is exactly five, followed only by zeros, there are two conventions that are in common use. The Student Evaluation and Records Branch accepts both conventions.

   a) The last digit retained should be increased by one if it is odd and left unchanged if it is even.

      e.g., 3.7500 rounded to 2 digits is 3.8
      3.65 rounded to 2 digits is 3.6

      OR

   b) The last digit retained should be increased by one.

      e.g., 3.7500 rounded to 2 digits is 3.8
      3.65 rounded to 2 digits is 3.7

APPENDIX B: EXPLANATION OF COGNITIVE LEVELS

1. Knowledge

   Knowledge is defined as including those behaviors and test situations that emphasize the remembrance, either by recognition or recall, of ideas, material, or phenomena. This level comprises knowledge of terminology, specific facts (dates, events, persons, etc.), conventions, classifications and categories, methods of inquiry, principles and generalizations, and theories and structures.

2. Comprehension and Application

   Application requires that the student applies an appropriate abstraction (theory, principle, idea, method) to a new situation.

   Comprehension refers to responses that demonstrate understanding of the literal message contained in a communication. This means that the student is able to translate, interpret, or extrapolate. Translation refers to the ability to put a communication into another language. Interpretation involves the reordering of ideas (inferences, generalizations, or summaries). Extrapolation is the ability to make estimates or predictions based on an understanding of trends or tendencies.

3. Higher Mental Activities

   Analysis, synthesis, and evaluation are included in the category of higher mental activities. Analysis comprises the ability to recognize unstated assumptions, to distinguish facts from hypotheses, to distinguish a conclusion from statements that support it, to recognize facts or assumptions that are essential to a main thesis or to the argument in support of that thesis, to distinguish cause-effect relationships from other sequential relationships, and to recognize a writer's viewpoint.

   Synthesis is the production of a unique communication. It is the ability to propose ways of testing hypotheses, the ability to design an experiment, to formulate and modify hypotheses, and to make generalizations.

   Evaluation is defined as making judgments about the value of ideas, solutions, and methods. It involves the use of criteria to appraise the extent to which details are accurate, effective, economical, or satisfying. Evaluation includes the ability to apply given criteria to judgments of work done, to indicate logical fallacies in arguments, and to compare major theories and generalizations.

APPENDIX C: USE OF CALCULATORS

GENERAL CLASSROOM USE

Since the last policy statement on the use of calculators was distributed in 1981, there has been a phenomenal change in the capacity and power of the pocket calculator. Very sophisticated machines are available to students at a very reasonable price. Scientific calculators, that is, calculators with the trigonometric and logarithmic keys, can and should be purchased and used by students in high school mathematics and physical science courses. Calculators with greater power and capacity to compute and store data bases and operate as electronic notebooks are also available, albeit at a price that is somewhat beyond what one would include as normal school supplies. As calculator technology changes, teachers will have to keep current with respect to the situation. At this time all Grade 12 students can be held responsible for acquiring and learning to use a scientific calculator.

The use of programmable calculators with numeric output should also be encouraged. The exercise of programming calculators is a valuable educational experience. Indeed, the electronic notebooks are also a useful teaching tool. Teachers should offer educational experiences based on the use of evolving technologies by providing challenging activities that lead to the integration of such technologies into the high school student's problem-solving strategies.

Similarly, Grade 9 students should be proficient in the use of calculators with memories. However, it is not expected that a provincial achievement test would require the use of such calculators. Thus, the use of calculators should be encouraged and a gradual increase of skill in the use of specialized functions should be expected throughout the school program so that mastery of such instruments is in place for high school.

While the use of calculators should be encouraged in the elementary grades, it is equally unlikely that there will be a requirement for such instruments on the grades 3 or 6 achievement tests.

Since the situation regarding the technology, availability, and use of calculators is still quite fluid, this policy will be reviewed on a yearly basis.

USE ON EXAMINATIONS

Policy

Alberta Education encourages the use of calculators in classrooms but, in order to ensure fairness and equity for students, the use of calculators that are equipped to show or print alphabetic output in natural language is not permitted on provincial examinations and tests. Students writing mathematics, chemistry, and physics diploma examinations are expected to have and use scientific calculators.

Guidelines

1. Approved calculators for use in examinations and tests administered on behalf of Alberta Education are characterized as those calculators which cannot graph mathematical functions, factor an algebraic function, accept alphabetic input nor produce alphabetic output, store natural language text, or attach to peripheral printers, disk drives, or other such devices.

2. Calculators with programmable features are approved for use in examinations provided that the memories have been cleared prior to the start of the examination or test.

Procedures

1. Presiding examiners will inspect all calculators brought into an examination room to ensure that this policy is not violated.

2. Assistance in clearing the memories of programmable calculators may be sought from other staff members.

3. Identification of approved calculators is the responsibility of the Chief Presiding Examiner and principal. Any exceptions to the guidelines must be approved by the Director, Student Evaluation and Records Branch, Alberta Education, prior to the day of the examination.